## CLAIMS

What is claimed is:

1. An method of making an organic memory cell comprising:

providing a first electrode on a substrate;

forming a photosensitive dielectric over the substrate;

patterning the photosensitive dielectric to provide a patterned dielectric having openings therein;

forming an organic semiconductor layer over the first electrode and within the openings of the patterned dielectric, the organic semiconductor layer comprising at least one of a conjugated organic polymer, a conjugated organometallic polymer, a buckyball, and a carbon nanotube;

providing a second electrode over the organic semiconductor layer; and

forming a passive layer comprising a conductivity facilitating compound between the first electrode and the organic semiconductor layer and/or between the second electrode and the organic semiconductor layer.

2. The method of claim 1, wherein patterning the photosensitive dielectric comprises

exposing a portion of the photosensitive dielectric to actinic radiation; and

developing the photosensitive dielectric by removing either exposed portions of the photosensitive dielectric or unexposed portions of the photosensitive dielectric.

3. The method of claim 1, wherein the organic semiconductor layer is formed using a spin-on technique, the spin-on technique comprising applying a mixture of i) at least one of a conjugated organic polymer, a conjugated organometallic polymer, a buckyball, and a carbon nanotube, and ii) at least one solvent selected from the group consisting of glycol ether esters, glycol ethers, furans, and alkyl alcohols containing from about 4 to about 7 carbon atoms.

4. The method of claim 1, wherein the photosensitive dielectric comprises at least one selected from the group consisting of polyimides, polyimide-polyacrylates, polyolefins, fluorocarbon polymers, benzocyclobutene, and organosilicons.

5. The method of claim 1, wherein the photosensitive dielectric comprises a photosensitive polyimide.

6. The method of claim 1, wherein the photosensitive dielectric comprises a photosensitive compound, and the photosensitive compound comprises at least one selected from the group consisting of aromatic substituted halohydrocarbons, halo-substituted sulfur containing compounds, haloheterocyclic compounds, azides, triazines, sulfonated esters, sulfonated ketones, halonium salts, quaternary ammonium salts, phosphonium salts, arsonium salts, aromatic sulfonium salts, aryl sulfonium salts, alkyl sulfonium salts, sulfoxonium salts, seleonium salts, alkylsulfonium salts, benzoin ether compounds, ketalin ether compounds, ketal compounds, acetophenone compounds, benzophenone compounds, thioxanthone compounds, organic peroxides, N-phenylglycine, triazine compounds and allene-iron complexes.

7. The method of claim 2, wherein the actinic radiation comprises at least one type or wavelength of radiation selected from the group consisting of 11 nm, 13 nm, 157 nm, 193 nm, 248 nm, 253 nm, 302 nm, 313 nm, 334 nm, 365 nm, 405 nm, 435 nm, 546 nm, X-rays, and e-beams.

8. The method of claim 1, wherein the organic semiconductor layer comprises at least one conjugated organic polymer selected from the group consisting of polyacetylene; polyphenylacetylene; polydiphenylacetylene; polyaniline; poly(p-phenylene vinylene); polythiophene; polyporphyrins; porphyrinic macrocycles, thiol derivatized polyporphyrins; polymetallocenes, polyphthalocyanines; polyvinylenes; and polystiroles.

9. A method of making an organic memory cell comprising:

providing a first electrode on a substrate;

forming a photosensitive dielectric over the substrate;

patterning the photosensitive dielectric to provide a patterned dielectric having openings therein;

forming a passive layer comprising a conductivity facilitating compound on the first electrode;

forming an organic semiconductor layer over the passive layer and within the openings of the patterned dielectric, the organic semiconductor layer comprising at least one of a conjugated organic polymer, a conjugated organometallic polymer, a buckyball, and a carbon nanotube; and

providing a second electrode over the organic semiconductor layer.

10. The method of claim 9, wherein patterning the photosensitive dielectric comprises

exposing a portion of the photosensitive dielectric to actinic radiation; and

developing the photosensitive dielectric by removing either exposed portions of the photosensitive dielectric or unexposed portions of the photosensitive dielectric.

11. The method of claim 10, wherein the exposed portions of the photosensitive dielectric are removed.

12. The method of claim 10, wherein the exposed portions of the photosensitive dielectric are removed using a hydroxide developer.

13. The method of claim 10, wherein the actinic radiation comprises at least one type or wavelength of radiation selected from the group consisting of 11 nm,

13 nm, 157 nm, 193 nm, 248 nm, 253 nm, 302 nm, 313 nm, 334 nm, 365 nm, 405 nm, 435 nm, 546 nm, X-rays, and e-beams.

14. The method of claim 10, wherein developing the photosensitive dielectric comprises contacting the photosensitive dielectric with at least one developer selected from the group consisting of a plasma, supercritical fluids, glycol ether esters, glycol ethers, furans, and alkyl alcohols containing from about 4 to about 7 carbon atoms, alkanes, mesitylene, toluene, aqueous hydroxide solutions, aqueous acidic solutions, organic acidic solutions, and organic basic solutions.

15. The method of claim 9, wherein the photosensitive dielectric comprises at least one selected from the group consisting of polyimides, polyimide-polyacrylates, polyolefins, fluorocarbon polymers, benzocyclobutene, and organosilicons.

16. The method of claim 9, wherein the organic semiconductor layer comprises at least one conjugated organic polymer selected from the group consisting of polyacetylene; polyphenylacetylene; polydiphenylacetylene; polyaniline; poly(p-phenylene vinylene); polythiophene; polyporphyrins; porphyrinic macrocycles, thiol derivatized polyporphyrins; polymetallocenes, polyphthalocyanines; polyvinylenes; and polystiroles.

17. An organic semiconductor memory device, comprising

a substrate;

a patternable, photosensitive dielectric on the substrate; and

a plurality of organic semiconductor memory cells comprising a first electrode, a passive layer adjacent the first electrode, an organic semiconductor layer comprising at least one of a conjugated organic polymer, a conjugated organometallic polymer, a buckyball, and a carbon nanotube adjacent the passive layer, and a second electrode adjacent the organic semiconductor layer,

wherein the patternable, photosensitive dielectric at least partially surrounds the plurality of organic semiconductor memory cells.

18. The organic memory cell of claim 17, wherein the photosensitive dielectric comprises at least one selected from the group consisting of polyimides, polyimide-polyacrylates, polyolefins, fluorocarbon polymers, benzocyclobutene, and organosilicons.

19. The organic memory cell of claim 17, wherein the photosensitive compound comprises at least one selected from the group consisting of aromatic substituted halohydrocarbons, halo-substituted sulfur containing compounds, haloheterocyclic compounds, azides, triazines, sulfonated esters, sulfonated ketones, halonium salts, quaternary ammonium salts, phosphonium salts, arsonium salts, aromatic sulfonium salts, aryl sulfonium salts, alkyl sulfonium salts, and sulfoxonium salts or seleonium salts and alkylsulfonium salts.

20. The organic memory cell of claim 17, wherein the first electrode and the second electrode independently comprise at least one selected from the group consisting of aluminum, chromium, copper, germanium, gold, magnesium, manganese, indium, iron, nickel, palladium, platinum, silver, titanium, zinc, and alloys thereof; indium-tin oxide; polysilicon; doped amorphous silicon; and metal silicides; the conductivity facilitating compound comprises at least one selected from the group consisting of copper sulfide, copper oxide, manganese oxide, titanium dioxide, indium oxide, silver sulfide, gold sulfide, nickel arsenide, cobalt arsenide, and iron oxide; and the organic semiconductor layer comprises at least one conjugated organic polymer selected from the group consisting of polyacetylene; polyphenylacetylene; polydiphenylacetylene; polyaniline; poly(p-phenylene vinylene); polythiophene; polyporphyrins; porphyrinic macrocycles, thiol derivatized polyporphyrins; polymetallocenes, polyphthalocyanines; polyvinylenes; and polystiroles.